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Indispensable Precautions for Handing Biological Samples of DNA Analyzes in Rescue of COVID-19 Transmission

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Abstract

The recovered biological traces from the sources of victim, suspect and from crime scene are most important types of evidences for forensic DNA analyzes. The collection of the evidences is important for DNA examination in the identification of suspect as well as innocent. The biological sources of DNA evidences may be blood, saliva, vaginal swabs, hair, teeth, bone etc. The method of the collection of evidences could differ from laboratory to laboratory in the current scenario coronavirus is constantly spreading. It may also be spread by touching contaminated objects or surfaces similarly it may also be transmitted by infected deceased. This study highlights some precautionary steps for medical and crime scene experts during the collection of forensic DNA evidences from biological sources to reduce the risk of the dispersion of COVID-19.

Keywords: Forensic DNA; Biological samples; DNA examination; Medical experts; COVID-19.

Introduction

Biological samples are used in DNA analyzes for the identification of suspect or any individual. Successful forensic DNA analyzes depends on the skill of collection and preservation of biological evidence.[1] DNA examination is necessary from the biological samples but there is a risk factor of the transmission of diseases during the collection of evidences. A most recently discovered coronavirus causes coronavirus disease called COVID-19. COVID-19 is a virus that can be easily transmitted from human to human through sneezes or coughs. In humans, respiratory infections cause from the common cold, fever, cough, breathing difficulties. The coronavirus can be spread from person to person through sneezes or coughs, direct contact with already infected persons, contaminated surfaces and objects, skin contamination and with contamination of mucosal surfaces (eye, mouth, nose, face).[2] A person may suffer with COVID-19 then safety measures is necessary during collection, handling and preserving of the biological samples.[3] Forensic genetics is developed to solve the legal issues like identification of the victims of mass disasters and individualization of the culprits of the crime through analyzes of forensic DNA.[4] The forensic exhibits collection is important in maternity/paternity disputes, identification of rape/murder, identification of mutilated remains/ deceased and in identification of missing child cases. A forensic or medical expert should know about the precautions and prevention at the time of collection of biological evidences.

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Incubation time COVID-19

Coronavirus Disease 2019 (COVID-19) first identified in Wuhan City, Hubei Province, China.[5] The virus can be spread easily between people who are in close contact with one another (within about 2 m or 6 feet). It can also spread from person-to-person through respiratory droplets when an infected person coughs or sneezes.[6] The Infection of this virus is also possible with touching own mucosa of mouth, nose, or eyes after contact with virus contaminated surfaces or objects. So, when accused may be infected with COVID-19 and incubation period is of 14 days then there are ample chances for getting infected during collection preservation and analyzes but in some cases, samples need to be collected immediately for further analyzes. Hence precautions are necessary during the collection of biological evidences that can be reduce the chance of the contamination or transmission of virus. The virus is known to normally survive a few hours outside the host, but this may extend to days in some conditions.[7]

Guidelines for precautions during collection and handling of biological samples in COVID-19

Latest recommendations from the World Health Organization is necessary for health personnel handling during COVID-19 pandemic conditions. Some precautions are necessary during the collection of biological evidences from the suspect, victim and scene of crime to avoid the transmission risk of COVID-19.

- All the necessary equipment must be present to avoid leave the area to find additional items.
- Single use disposable non-latex gloves should be used and protective gloves made of Kevlar or neoprene.
- The personal protective equipment should be used appropriately by medical and forensic experts that covers the entire body, including the forearms to avoid direct contact with the body of victims and objects at the scene of crime.
- A protection of hair, face, eyes and mouth is necessary with clean hands by a use of alcohol-based sanitizer.
- Use a plastic face shield or a face mask and goggles to protect the face, eyes, nose, and mouth from splashes of potentially infectious bodily fluids.
- Respiratory protection with a standard surgical mask to excludes the small particles of infective substantial during the collection of evidences from the scene of crime.
- Do not touch the mask during the collection of evidences, also avoid touching face, eyes, nose and mouth.
- A water proof plastic gown that covers the entire body, including the forearms.
- Rubber boots with metal-protected toe caps and dorsal reinforcement.

Types of samples collection for DNA analyzes

Forensic biological samples comprise DNA evidences which found in a variety of biological fluids and tissues such as human blood, semen, saliva, epithelial cells, hair, bone, teeth, fingernails, and putrefied tissues.[8] From a single source the collection of the samples as much sample as possible. Once the sample to be collected is identified, dry and pack the sample for transportation to the laboratory. Forensic DNA analyzes includes examination of evidence, identification of body fluid, extraction of DNA, assessment of extracted DNA, amplification of target loci, detection of amplified products, analyzes of data, and report generation.[9]

Forensic samples for DNA analyzes

For the identification of deceased blood samples of the blood relatives, body remains like tissue, teeth, bone of the deceased at least 3-4 (if available).

In homicide case stained earth/cement/brick (blood stained portion), any clothing/bedsheet etc. available weapon of offence, rooted hairs may be found, bidi, cigarette stub/chewing-gum can be recovered from the spot. In sexual assault cases clothing/bedsheet, condoms, weapon/object (suspected) evidences can be taken and recovered for the identification of rapist from the spot.

In sexual assault offences blood samples of the accused/suspect, clothing, undergarment in case of assault with minor (where bleeding is suspected) can be collected from suspect and from victim garments, vaginal slides, vaginal swabs, pubic hair and nails can be collected for DNA examination. Blood sample, Penile swab and nails if transfer of skin tissue in case of minors.

Samples collection from the scene of crime and precautions

Personal protective equipment (PPE) is recommended as it provides adequate protection, if properly used. During the collection of evidences PPE is must at crime scene of known or suspected COVID-19 cases to decrease the risk of transmission of contagious disease.[10] To avoid the infection facial protection and hand protection is must during collection of evidences from the known or suspected victim and suspect of COVID-19. Always wear PPE with wash and sanitized hands. An alcohol-based hand sanitizer may be used that contains 60%-95% alcohol. However, the virus is easily neutralized with water and soap and with standard disinfectants, such as bleach and ethanol solutions.[6]

Cotton swabs are usually been used to collect biological samples. Try to dry this sample immediately after collection to minimize the degradation of the sample.[11] To avoid contamination, do not allow the biological evidence stain to come into contact with any other biological sample and protect it from contact with another people or surfaces. Frequently change gloves and sanitized your hands every time when changing. Do not touch face or any other objects during the collection of forensic biological evidences. Each individual stain or evidence should be collected separately. Clean tools (e.g. tweezers, scissors) with distilled water and drying thoroughly with tissue. Do not talk or cough over biological evidence. Always wear mask in order to decrease.

Packing of DNA Exhibits

After the collection of samples, it should be marked, packed and sealed separately to avoid sample loss and cross contamination. The packaging of samples is useful to maintain and record the chain of custody and to describe the evidence. Each sample should be separately sealed and packed in specified packaging material.[11] Use paper bags or envelopes (do not use plastic) to package all biological evidence in. The packaging of biological evidence in plastic or airtight containers should be avoided, because the accumulation of remaining moisture might be contributing in the growth of bacteria and fungi.[12]

List of Personal protective equipment (PPE) in suspected coronavirus disease 2019 (COVId-19) cases

- Single use disposable non-latex gloves
- Water-resistant gown to cover whole body and forearms
- Waterproof apron
- Goggles or face shield
- Disposable N-95 respirator or higher
- Rubber boots with metal toecaps
- Fold flat and molded protection mask or whole- body suit
- Additional protective equipment in suspected COVId-19 cases

Reusable PPE (e.g., goggles, face shields, and PAPRs) must be cleaned and disinfected according to the manufacturer's recommendations before or after use. Immediately, wash hands with soap and water for 20 seconds. An alcohol-based hand sanitizer that contains 60%-95% alcohol may be used. However, if hands are visibly dirty, always wash hands with soap and water. Avoid touching the face with unwashed hands. Ensure that hand hygiene facilities are readily available.

Precautionary steps of laboratory during receiving and handling of biological samples

Special precaution should be taken while receiving cases in the laboratory.

- Face should be covered before entering the laboratory.
- Hands should be sanitized with alcohol-based sanitizer and should wear gloves to mask the hands.
- All documents those are exchanged must be kept under UV radiation for 15-20 minutes to sterilize them, prior to be used by the other person.
- All personnel use proper gowning like gloves, mask, shoe cover, head covers, goggles and anti-absorbent aprons.
- Personnel's should properly follow the rule of social distancing during working inside the laboratory.
- Should separately process any exhibit with high chance of COVID-19 contamination.
- Precautions should be taken while receiving exhibit during and even after this global COVID-19 pandemic.
- The working area and equipment's should be cleaned properly with 0.-1.0% NaOCl (Sodium Hypochlorite).

- Personnel's should strictly follow the Biohazard guidelines for discarding any waste.
- Personnel's should remove the PPE's and discard in destined bins while leaving lab and follow the proper sanitization while returning home.

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